

# TYPHOON HOPE

BEST TRACK TC-25W

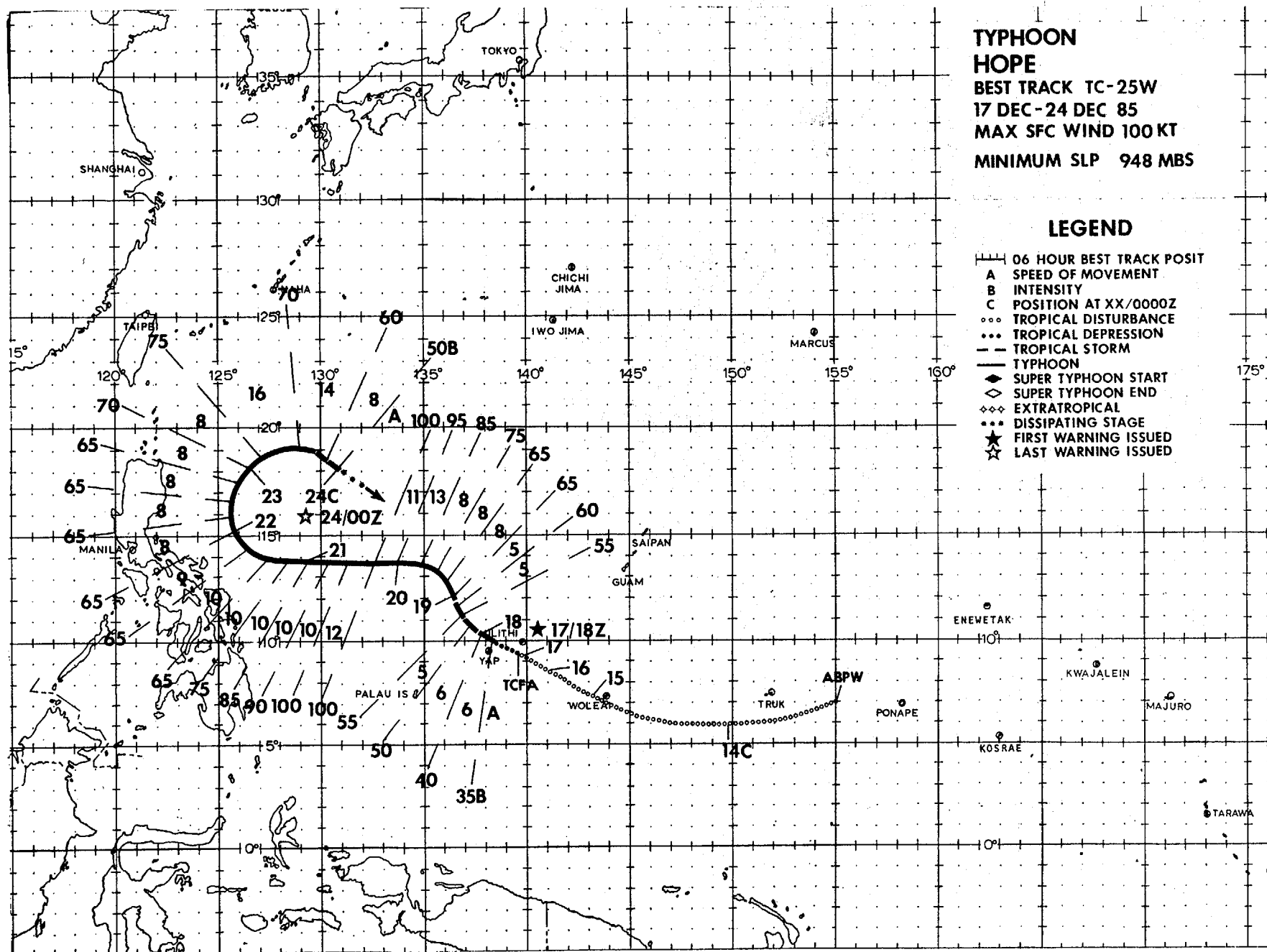
17 DEC-24 DEC 85

MAX SFC WIND 100 KT

MINIMUM SLP 948 MBS

## LEGEND

- 06 HOUR BEST TRACK POSIT
- A SPEED OF MOVEMENT
- B INTENSITY
- C POSITION AT XX/0000Z
- ... TROPICAL DISTURBANCE
- ... TROPICAL DEPRESSION
- TROPICAL STORM
- TYPHOON
- ◆ SUPER TYPHOON START
- ◇ SUPER TYPHOON END
- ◆◆ EXTRATROPICAL
- ◆◆ DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED



# TYPHOON HOPE (25W)

Hope was a late-season typhoon that originated at low-latitude in the near-equatorial trough. It was aided in its initial development by the presence of enhanced low-level northeast monsoon flow and an associated shear zone. Typhoon Hope presented forecast problems at two different times: first at the crucial turning point from a westward to a northward track; and after recurvature when extratropical transition was imminent.

After Tropical Storm Gordon dissipated over Vietnam on the 25th of November, a winter weather pattern dominated the northwest Pacific area. Convective activity was confined to low latitudes in the near-equatorial trough. The disturbance, that was to become Typhoon Hope, was detected on the 13th of December between Truk and Pohnpei. The disturbance moved in a general westerly direction for the next three days and showed signs of slow intensification. Figure 3-25-1 shows Hope as a tropical depression located approximately 90 nm (167 km) east of Yap. By 171800Z, satellite data indicated the disturbance had further intensified while moving west-northwestward

aided by the effect of the shear zone to the north. As a result, the initial warning was issued. Between 171800Z and 191200Z December, Hope moved northwest before coming under the full steering influence of the mid-level subtropical ridge that caused the system to assume a westward track.

Tracking Hope during the period 191200Z-201200Z was facilitated by the availability of four aircraft fixes and several satellite eye fixes. Typhoon Hope reached its maximum intensity of 100 kt (52 m/s) at 200600Z (see Figure 3-25-2) just thirty hours after the initial warning. After that, Hope decreased slightly in intensity and maintained 65-75 kt (34-39 m/s) during the period 210600Z-231200Z.

After the 200300Z warning, the One-way Interactive Tropical Cyclone Model (OTCM) showed definite indications of a recurvature type track, whereas before it had indicated a generally north-westward track. The OTCM is the primary forecasting aid. The Nested Tropical Cyclone Model (NTCM) did not show signs of recurvature, but did indicate a

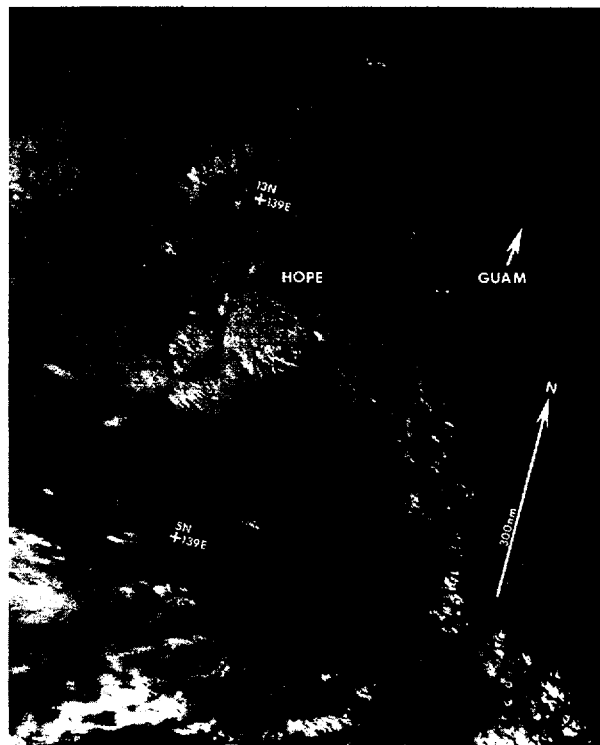


Figure 3-25-1. Hope as a tropical depression approximately 90 nm (167 km) east of Yap (WMO 91413). The shear zone to the north apparently aided Hope's development by enhancing the low-level northeast flow (170441Z December NOAA visual imagery).

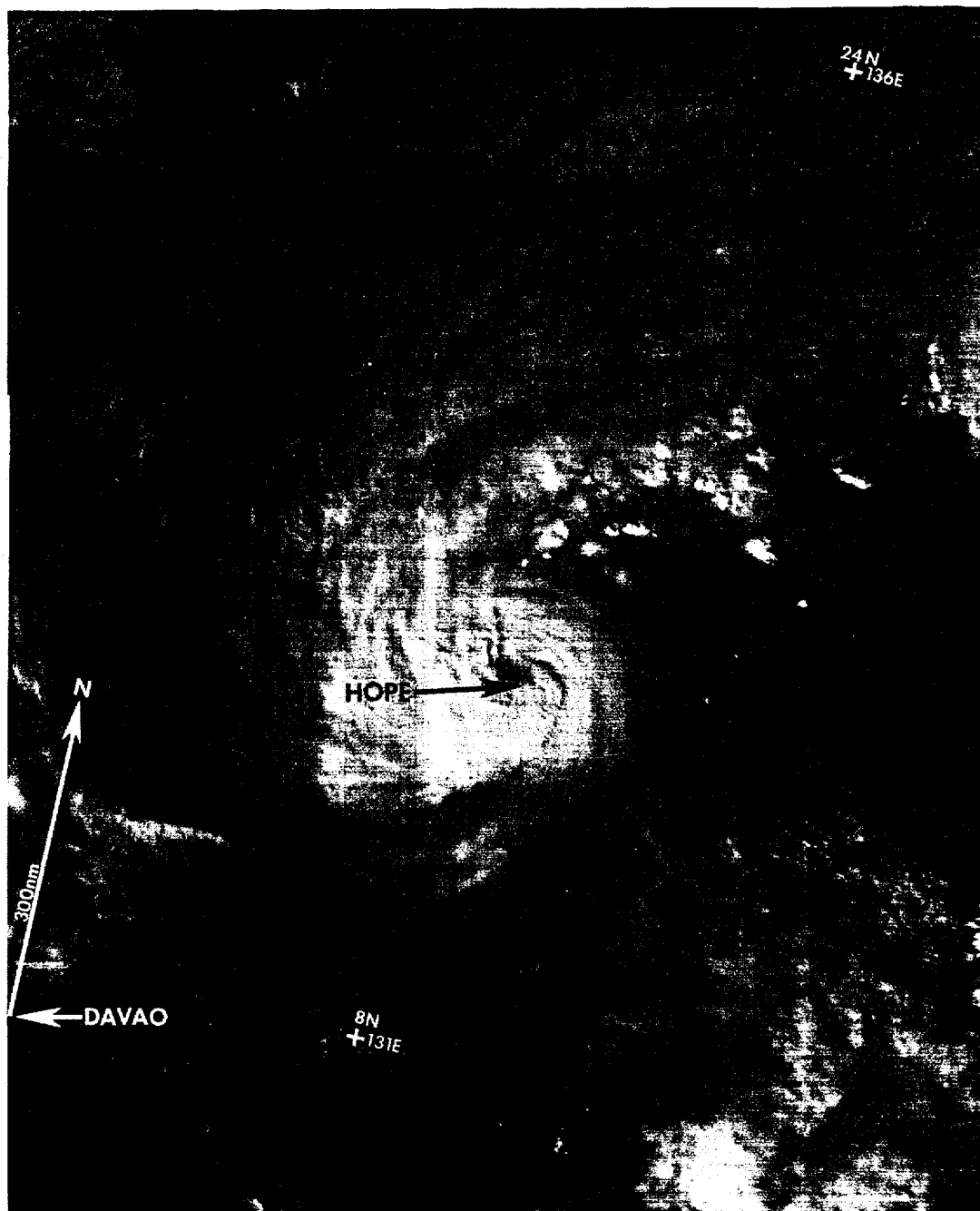


Figure 3-25-2. Typhoon Hope with a large ragged eye near time of maximum intensity (200551Z December NOAA visual imagery).

northerly track. As indicated in Figure 3-25-3, the OTCM yielded good forecast guidance during the period 191800Z-201200Z and the NTCM (Figure 3-25-4) gave fairly good guidance during the period 191800Z-210000Z. OTCM indicated a northwestward track and recurvature to the north-northeast (Figure 3-25-3) after about 48 hours. NTCM indicated a track change from northwest to northward (Figure 3-25-4). This guidance was integrated into the 201500Z warning. The track made good synoptic sense since it could be interpreted as Typhoon Hope moving around the western periphery of the mid-level subtropical ridge. The forecasts held with a curving track that started toward the west-northwest, turned north, and became northeast at about the 48 hour point.

After 201200Z December, a sequence of events started that caused major track forecast problems. As has been pointed out earlier, after 201200Z Typhoon Hope began to weaken slightly and the eye structure disappeared from satellite imagery. This resulted in doubts about the exact location of the

surface center of the typhoon. At 210842Z, a 31 hour period began during which no aircraft fixes were made on Typhoon Hope due to aircraft non-availability and maintenance problems. Under normal conditions, four aircraft fixes would have been made during that time period. Aircraft positioning of typhoons is the most accurate method available and is especially important at major track changes.

After 210000Z, the OTCM guidance stopped the recurvature scenario and started showing just a general northwest movement (Figure 3-25-5). It indicated a more westward direction with each run of the model. NTCM also indicated a northward track until 210000Z. After that time, it went to a straight westward track (Figure 3-25-6). This erroneous guidance (ie. the westward track) reflected OTCM and NTCM's inability to forecast in a winter synoptic situation. With specific reference to the model, strong middle-to-upper level westerlies apparently caused an early termination of the model run, or (as in this case) misleading guidance.

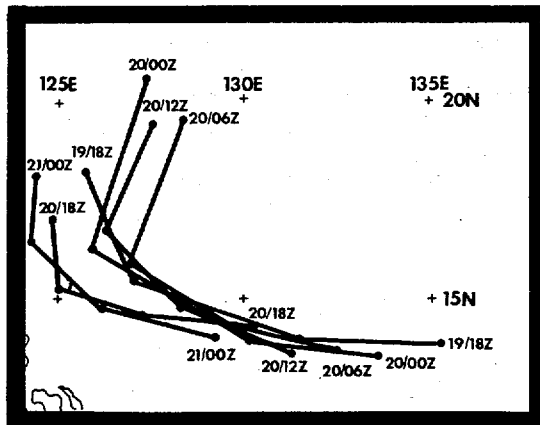


Figure 3-25-3. One-way interactive Tropical Cyclone Model (OTCM) forecast tracks for the period 191800Z-210000Z December showing a recurvature track.

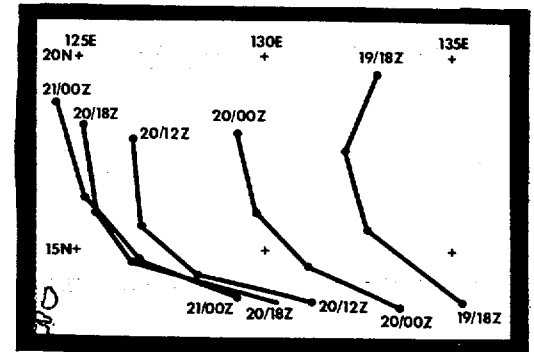


Figure 3-25-4. Nested Tropical Cyclone Model (NTCM) forecast tracks for the period 191800Z-210000Z December showing fairly good forecast track guidance in the form of tracks with northward movement.

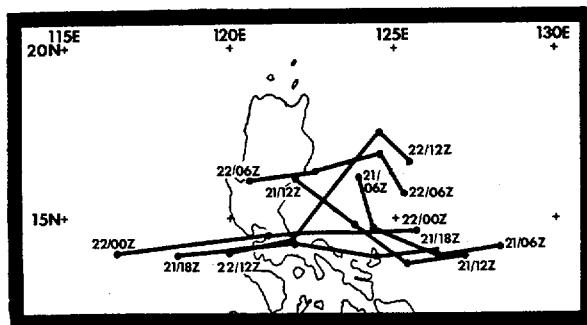
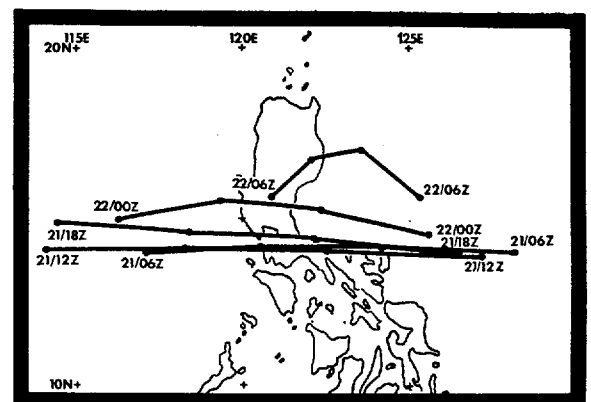


Figure 3-25-5. One-way interactive Tropical Cyclone Model (OTCM) forecast tracks for the period 210600Z-221200Z December. The forecast guidance indicates that the recurvature track is changed to westerly with time.

Figure 3-25-6. Nested Tropical Cyclone Model (NTCM) forecast guidance for the period 210600Z-220600Z December showing the swing to an almost straight westward track.



The final factor leading up to the forecast problem was Hope's continued west-northwestward movement and decreasing distance from Luzon. There was a definite need to warn of Hope's approach if there was a possibility that it was going to continue moving west-northwest and not recurve.

The combination of these events presented a dilemma for the typhoon forecaster, who had to issue the 220300Z warning. Hope was close to the critical track turning point. It was either going to continue moving west-northwest and make landfall on the east coast of Luzon, or start moving northward and recurve as had been forecast for the past 36 hours. The forecaster was presented with the following facts: (1) Hope's position was known within an estimated accuracy of 60 nm (111 km) based on poorly defined infrared satellite fixes (no satellite eye fixes or aircraft fixes being available); (2) Hope appeared to be continuing on a west-northwest track; (3) the numerical forecast models were indicating a straight westward track and had not indicated recurvature for about 24 hours; and (4) there was a definite need to warn Department of Defense interests on Luzon of Hope's approach. After carefully considering the combined effect of these factors, the forecaster decided to significantly change the forecast philosophy and forecast Typhoon Hope to track west-northwest across Luzon into the South China Sea.

During the next six hours; however, satellite fixes indicated that Typhoon Hope was moving toward

the north. A quick recovery was made on the 220900Z warning when the forecast track was switched back to one reflecting northward movement, followed by recurvature to the northeast, and decreasing intensity as extratropical transition occurred. The warnings over the next two days were accurate with a general concept of eastward movement with extratropical transition. The forecast tracks had Hope accelerating in speed and moving as far east-northeast as 27N 149E before completing extratropical transition.

In retrospect, an extratropical transition where the tropical cyclone is sheared away by upper-level westerlies and then dissipates below 20N would have been a more representative forecast for the final two days. Climatologically, this is what one would expect to happen in late December. In the case of Typhoon Hope, the 400mb trough with moderate westerlies over southern China was super-imposed over moderate-to-strong anticyclonic flow and cold air advection at the 925 mb level. These features are depicted in Figures 3-25-7 and 3-25-8. Based on these patterns, a shearing type of extratropical transition (followed by a dramatic decrease in the system's associated wind speeds) with no significant eastward acceleration is to be expected. Shearing, decreased wind speeds, and no significant eastward acceleration is exactly what happened after 240000Z. Figure 3-25-9 shows the remnants of Hope. There were no reported deaths, injuries, or property damage attributed to this late-season typhoon.

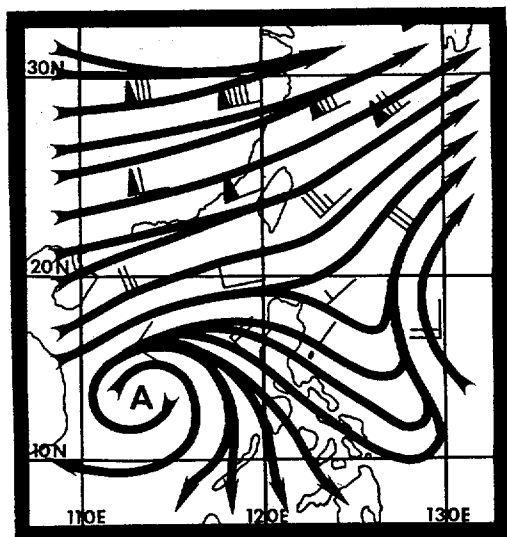


Figure 3-25-7. 400 mb Numerical Variational Analysis (NVA) at 220000Z December indicates a trough extends from near 60N 130E to 22N 107E with moderate westerlies north of Hope.

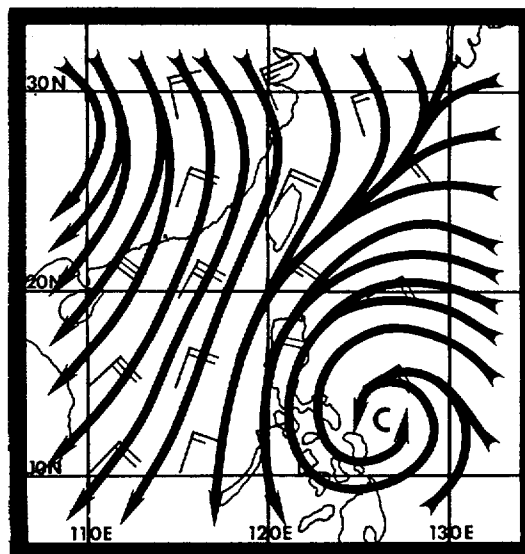


Figure 3-25-8. 925 mb NVA analysis at 220000Z showing moderate-to-strong anticyclonic flow and cold air advection over southern China.

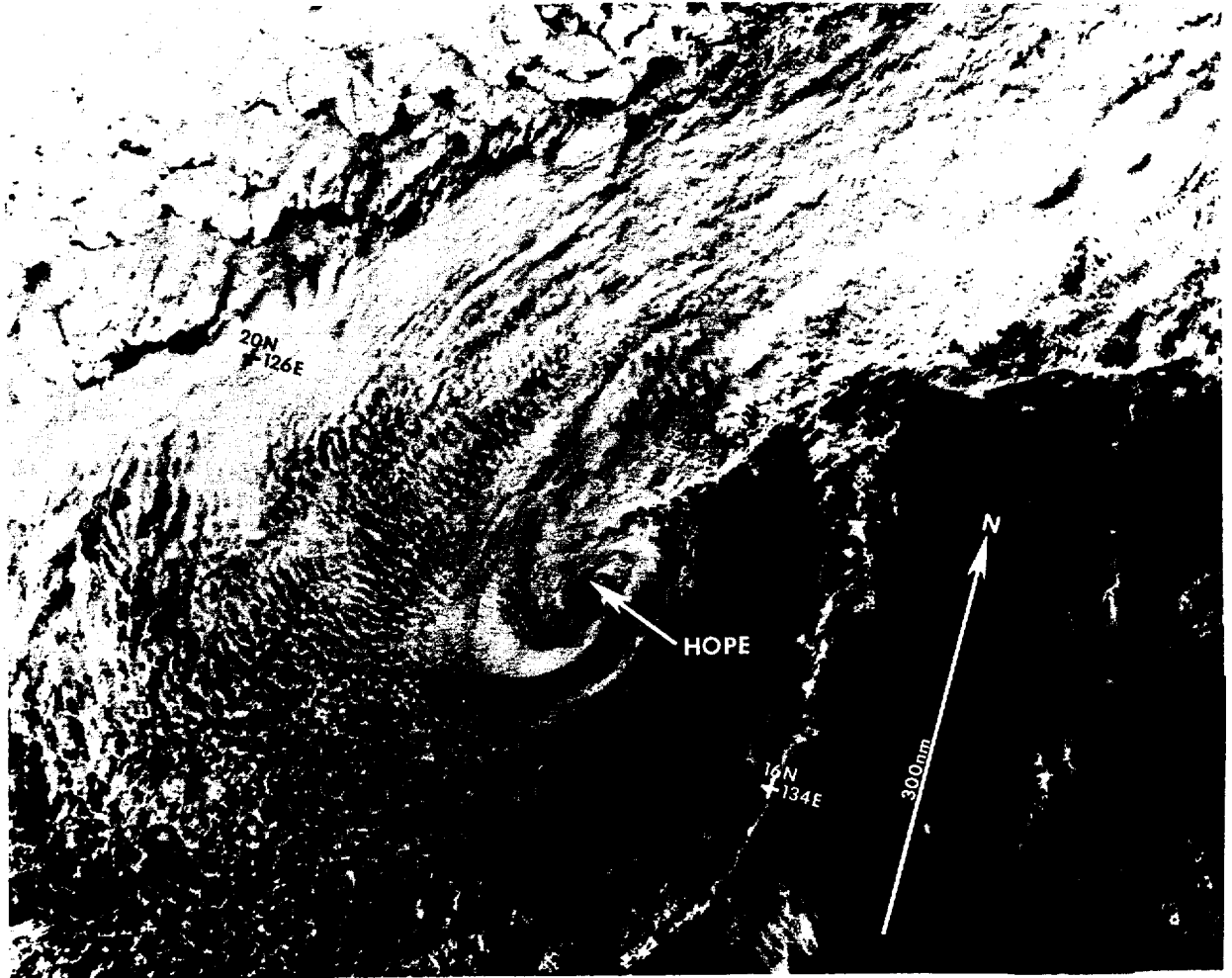


Figure 3-25-9. Typhoon Hope dissipating after having the central convection sheared away by mid- to upper level westerlies (240042Z December DMSP visual imagery).